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AUTHOR Findlen, George L.
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ABSTRACT

Small community colleges with enrollments between 500 and 2,500 students have traditionally been unable to afford to hire an institutional researcher or to lease sophisticated statistical packages to perform enrollment analyses, though their needs for enrollment projections are the same as those of larger institutions. Fortunately, with a personal computer, a desktop printer, and the Lotus 1-2-3 software package, a dean with initiative and curiosity can gain valuable program information at a relatively small cost. One of the primary strengths of Lotus 1-2-3 is that it allows a user to do linear regression to project trends in enrollments, dropouts, or total annual revenue. Though the benefits of having past and likely future enrollments on a single sheet of paper or screen are obvious, users should be cautioned that future enrollments are assumed to adhere absolutely to the trend line established by all past enrollments entered into the template, and that linear regression should not be used to project more than two semesters of future enrollment if there are only 10 semesters in the enrollment history section. The following materials concerning the use of Lotus 1-2-3 in enrollment projections are included: (1) contents to be typed into each cell of a 1-2-3 spreadsheet to create a template for projecting future enrollments; (2) a set of instructions for using the template as-is and for modifying it; and (3) illustrations of blank and completed templates, and a sample graph. (UCM)

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Enrollment Projections: Template and Guide

George L. Findlen
Delgado Community College
New Orleans, LA

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ENROLLMENT PROJECTIONS: TEMPLATE AND GUIDE

George L. Findlen
Delgado Community College
New Orleans, LA

Small community colleges with enrollments between 500 and 2,500 students have traditionally not been able to do much institutional research. That is because they have not had the money to hire an institutional researcher or to lease sophisticated statistical packages like SAS (Statistical Analysis System).

Their needs, however, are the same as those at larger community colleges of 5,000 and 10,000 students. For instance, small community college administrators want to intervene where intervention is called for to strengthen faltering programs. They need to know which programs are likely to have lower future enrollments so that they can intervene before it is too late. In addition, since monies spent on full-time faculty and equipment are future investments, small community college deans, no less than large community college deans, need to project which programs are likely to increase and which are likely to decrease so that they can use their limited resources for faculty and equipment in areas of stable and growing enrollments.

The electronics revolution has provided an answer to this forecasting need. Most small institutions boast at least one personal computer. And most PC users have access to one of the more powerful and widely used software packages sold for the PC market: the Lotus 1-2-3

desktop printer and $200 to $500 (used or new) for 1-2-3, a dean with initiative and curiosity can gain valuable program information for about 10% of what it costs to employ a full-time institutional researcher.

One of the primary strengths of Lotus' 1-2-3 is that it does calculations which permit a user to do linear regression, a mathematical model which can be used to make enrollment projections. My purpose here is not to explain the statistic--I will let a graduate statistics textbook do that. Let it suffice to say that linear regression calculates a line which best fits the trend of past data. When extended, the line calculates future data points. The data can be enrollments, dropouts, total annual revenue, or anything else that can be counted.

Having discovered this ability of 1-2-3 to do calculations, I created a spreadsheet to project four semesters of enrollments from the preceding ten using linear regression. In the event that my spreadsheet will help you, I enclose it here. Appendix A contains the contents to be typed into each cell of a 1-2-3 spreadsheet (version 1a or 2.01) to create a template for projecting future enrollments. I call the template "Futenrol." (For those not familiar with 1-2-3, a template is a model or blank form that users can make a new copy of each time they want to plug in a different set of figures.) Appendix B gives a set of instructions for using the template as-is and for modifying it. Figures 1,2, and 3 show what a blank template will look like on your monitor, while figures 4,5, and 6 show what a filled-in template looks like. Finally, figure 7 shows a graph that can be made from it. The template comes with two macro commands that will print the data table and create a graph of it. (See paragraph 9 of "Using the Template As-Is" in Appendix B.)

The benefits of Futenrol soon become obvious to the user. One benefit of Futenrol is that administrators have all actual past and likely future enrollments on a single sheet of paper (or screen). (See Figure 4.) They do not need ten computer printouts in front of them at one time. So it is handy. The numbers enable administrators to make more reasonable estimates of future space and faculty needs. A second benefit is the graph macro; it generates a simple bar chart which depicts that program or institution's condition at a glance. Administrators can easily make a xerox or transparency of it for an academic council or board of trustees presentation. A third benefit is its simplicity and ease of use. Once 1-2-3 is loaded, a few keystrokes make a clean copy of Futenrol. Entering the enrollment history data takes just a few moments. Only two keystrokes produce a printout of screen one with all the data; two more produce the graph of it. A fourth benefit is the template's adaptability. With five minutes of effort, the template can be modified to handle more or fewer semesters. Moreover, the template will project future figures for just about anything countable--fall semester enrollments, first-time enrollments, majors, program completers, self-generated revenues, part-time faculty, or number of different courses offered. The template can use data recorded each week, month, semester, or year for a program, division, campus, or the institution.

Two strong cautions about linear regression are in order for users of Futenrol. First, the statistic assumes that future enrollments will adhere absolutely to the trend line established by all past enrollments entered into the template. The assumption is violated--and the resulting projections are misleading--if there is a radical fluctuation

at either end of the enrollment history. Users should prefer the old eyeball method in cases like that, paying particular attention to the most recent semesters. Likewise, if the data varies significantly up and down from one semester to the next, or if the history shows a major slump or peak, the assumption will be violated as well. The trend should be consistent in order to be reliable; the statistic is a weaker predictor if enrollment history goes down for the first five semesters and then up for the next five. In addition, the assumption is violated if there is an event in the present that will nullify the past. For example, a steady demand for welders in the past is meaningless as a predictor of future demand if the local shipyard just went bankrupt last week!

The second caution is that linear regression should not be used to project more than two semesters of future enrollment if there are only ten semesters in the enrollment history section. The statistic is generally not reliable if it is used to project more. Over-stretching the history data is comparable to predicting the weather four months from now in Peoria, IL. The whole purpose of the statistic is to replace opinionated guessing with reasonable probability, not to automate the opinionated guessing. The template given in Appendix A and portrayed in the figures violates this rule by projecting four semesters from twelve. However, it does so for visual effect only and is not used for planning purposes. On my campus, the template is only used to identify programs that may be in need of intervention and is not used to determine which programs need more faculty or space.

Administrators can make quality decisions only when they have adequate information at hand. The academic vice-president and campus deans at my institution have found the template useful. I hope you will as well.

Figure 1. Screen One of the Blank Template.

[PROGRAM TITLE (Campus)]
ENROLLMENT HISTORY from [term year] through [term year] and
ENROLLMENT PROJECTION (term year -- term year) via LINEAR REGRESSION
Formula: Projected Enrollment = (Slope * Semester) + Intercept
Y = AX + B

--------History--------		------Projection------		
Semester	Enrollment	Semester		Enrollment
Fall	198	Fall	198	0
Spring	198	Spring	198	0
Fall	198	Fall	198	0
Spring	198	Spring	198	0
Fall	198			
Spring	198			
Fall	198			
Spring	198			
Fall	198			
Spring	198			
Fall	198			
Spring	198			

Author: Dr. George L. Findlen
Curriculum Development
Delgado Community College
501 city Park Avenue
New Orleans, LA 70119
(504)483-4040

Figure 2. Screen Two of the Blank Template.

LINEAR REGRESSION FORMULA CALCULATIONS

Sem.("X")	X©2	Y©2	X * Y	Trended Datapoint	
1	1	0	0	0	
2	4	0	0	0	Slope =
3	9	0	0	0	
4	16	0	0	0	Intercept =
5	25	0	0	0	
6	36	0	0	0	
7	49	0	0	0	Sum of X =
8	64	0	0	0	
9	81	0	0	0	Sum of Y =
10	100	0	0	0	
11	121	0	0	0	N =
12	144	0	0	0	
78	650	0	0		

Figure 3. Screen Three of the Blank Template.

```
    GRAPH STUFF                 Graph Macro = [Shift][Ctrl] G

0 F             80-1            /GRGTBXR4..R19"AP4..P19"
0 S                             OLASemester Enrollment"TF®B1"
0 F             81-2            TSEnrollment History and Projection
0 S                             TX78-86 = History; 86-88 = Projection
0 F             82-3            TYEnrollments"DAQ4..Q19"AQQV
0 S
0 F             83-4
0 S                             Print Macro = [Shift][Ctrl] = P
0 F             84-5
0 S                             /PPRA1..G25"GPQ
0 F             85-6
0 S
0 F             86-7
0 S
0 F             87-8
0 S
```

Figure 4. Screen One of a Filled-in Template.

COMMERCIAL ART -- City Park
ENROLLMENT HISTORY from Fall 1980 through Spring 1986 and
ENROLLMENT PROJECTION (Fall 1986 -- Spring 1988) via LINEAR REGRESSION
Formula: Projected Enrollment = (Slope * Semester) + Intercept
Y = AX + B

--------History--------		------Projection------	
Semester	Enrollment	Semester	Enrollment
Fall 1980	322	Fall 1986	279
Spring 1981	302	Spring 1987	276
Fall 1981	302	Fall 1987	273
Spring 1982	318	Spring 1988	270
Fall 1982	299		
Spring 1983	299		
Fall 1983	284		
Spring 1984	277		
Fall 1984	318		
Spring 1985	301		
Fall 1985	269		
Spring 1986	281		

Figure 5. Screen Two of a Filled-in Template.

LINEAR REGRESSION FORMULA CALCULATIONS

Sem.("X")	X©2	Y©2	X * Y	Trended Datapoint		
1	1	103684	322	314		
2	4	91204	604	311	Slope =	-2.92
3	9	91204	906	308		
4	16	101124	1272	305	Intercept =	316.67
5	25	89401	1495	302		
6	36	89401	1794	299		
7	49	80656	1988	296		
8	64	76729	2216	293	Sum of X =	78
9	81	101124	2862	290		
10	100	90601	3010	287	Sum of Y =	3572
11	121	72361	2959	285		
12	144	78961	3372	282	N =	12
78	650	1066450	22800	3572		

Figure 6. Screen Three of a Filled-in Template.

GRAPH STUFF — Graph Macro =[Shift][Ctrl] G

322 F	80-81	/GRGTBXR4..R19"AP4..P19"
302 S		OLASemester Enrollment"TF®B1"
302 F	81-82	TSEnrollment History and Projections
318 S		TX80-86 = History; 86-88 = Projection
299 F	82-83	TYEnrollments"DAQ4..Q19"AQQV
299 S		
284 F	83-84	
277 S		Print Macro = [Shift][Ctrl] P
318 F	84-85	
301 S		/PPRA1..G25"GQ
269 F	85-86	
281 S		
279 F	86-87	
276 S		
273 F	87-88	
270 S		

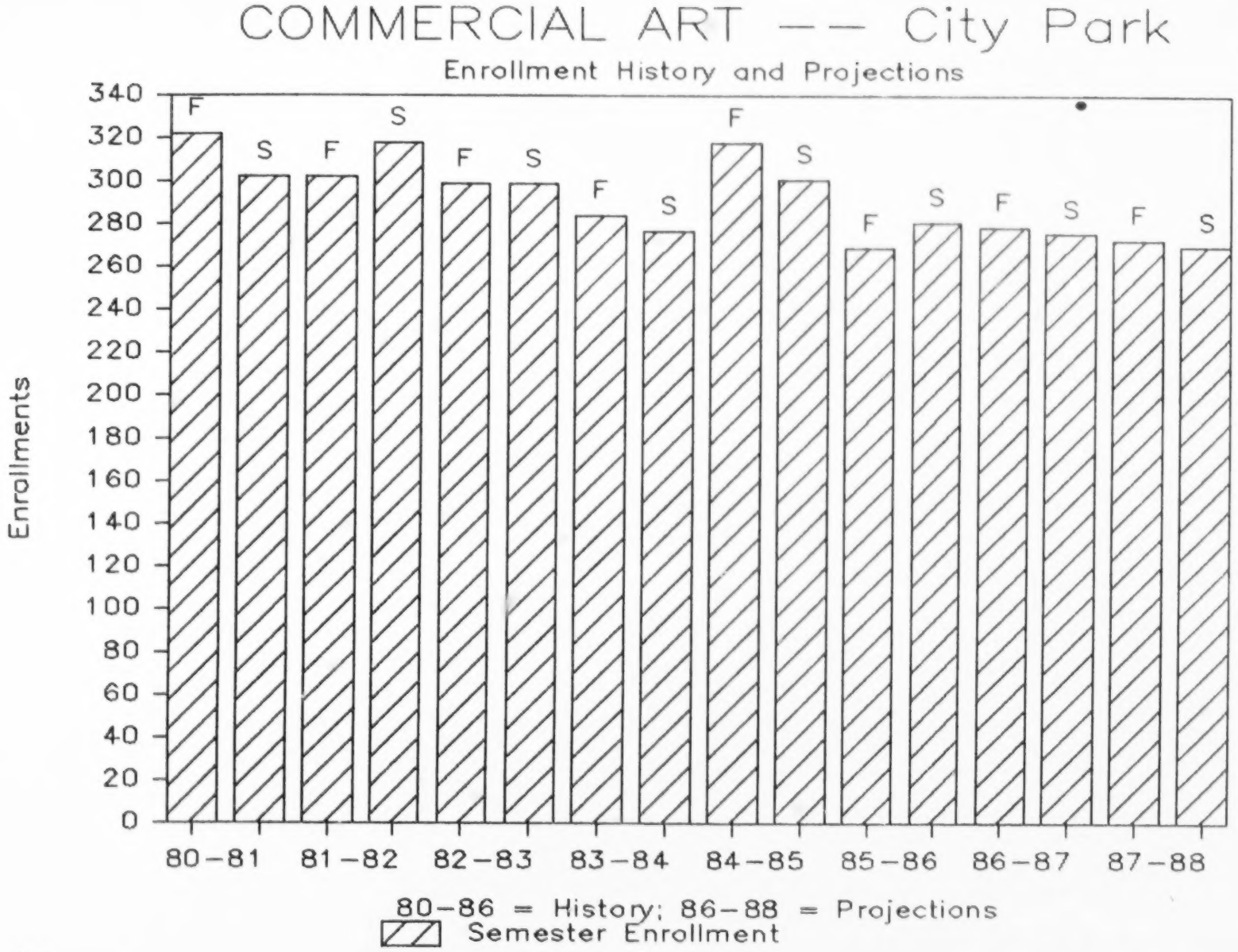

Figure 7. Graph of a Filled-in Template.

APPENDIX A: Template Cell Contents for 'Futenrol'

NOTE: Six of the column widths need to be reset. Reset column A to 12, B to 12, C to 5, D to 11, M to 6, and N to 11; leave all others at their default width of 9. Columns E, L, and P need to be / Range Format Fixed to zero decimal points, while O7 and O9 need to be / Range Format Fixed to two decimal points.

```
B1: '[PROGRAM TITLE (Campus)]
A2: 'ENROLLMENT HISTORY from [term year] through [term year] and
A3: 'ENROLLMENT PROJECTION (term year -- term year) via LINEAR REGRESSION
A4: 'Formula:  Projected Enrollment = (Slope * Semester) + Intercept
C5: '     Y = AX + B

A7: '--------History--------
A8: 'Semester
A10: 'Fall   198
A11: 'Spring 198
A12: 'Fall   198
A13: 'Spring 198
A14: 'Fall   198
A15: 'Spring 198
A16: 'Fall   198
A17: 'Spring 198
A18: 'Fall   198
A19: 'Spring 198
A20: 'Fall   198
A21: 'Spring 198


B8: "Enrollment

D7: ©------Projection------
D8: 'Semester
D10: 'Fall   198
D11: 'Spring 198
D12: 'Fall   198
D13: 'Spring 198
D15: 'Author:  Dr. George L. Findlen
D16: '         Curriculum Development
D17: '         Delgado Community College
D18: '         501 city Park Avenue
D19: '         New Orleans, LA 70119
D20: '         (504)483-4040

E8: 'Enrollment
E10: (F0) ($O$3*13)+$O$5
E11: (F0) ($O$3*14)+$O$5
E12: (F0) ($O$3*15)+$O$5
E13: (F0) ($O$3*16)+$O$5
```

```
H5: 'Sem.("X")
H6: 1
H7: 2
H8: 3
H9: 4
H10: 5
H11: 6
H12: 7
H13: 8
H14: 9
H15: 10
H16: 11
H17: 12
H18: ©---------
H19: @SUM(H4..H17)

I5: "X©2
I6: +H4*H4
I7: +H5*H5
I8: +H6*H6
I9: +H7*H7
I10: +H8*H8
I11: +H9*H9
I12: +H10*H10
I13: +H11*H11
I14: +H12*H12
I15: +H13*H13
I16: +H14*H14
I17: +H15*H15
I18: ©---------
I19: @SUM(I4..I17)

J2: 'LINEAR REGRESSION FORMULA CALCULATIONS
J5: "Y©2
J6: +B10*B10
J7: +B11*B11
J8: +B12*B12
J9: +B13*B13
J10: +B14*B14
J11: +B15*B15
J12: +B16*B16
J13: +B17*B17
J14: +B18*B18
J15: +B19*B19
J16: +B20*B20
J17: +B21*B21
J18: ©---------
J19: @SUM(J4..J17)

K5: "X * Y
K6: +H4*B10
K7: +H5*B11
K8: +H6*B12
K9: +H7*B13
```

```
K10: +H8*B14
K11: +H9*B15
K12: +H10*B16
K13: +H11*B17
K14: +H12*B18
K15: +H13*B19
K16: +H14*B20
K17: +H15*B21
K18: ©---------
K19: @SUM(K4..K17)

L4: 'Trended
L5:  'Datapoint
L6: (F0) ($O$3*H4)+$O$5
L7: (F0) ($O$3*H5)+$O$5
L8: (F0) ($O$3*H6)+$O$5
L9: (F0) ($O$3*H7)+$O$5
L10: (F0) ($O$3*H8)+$O$5
L11: (F0) ($O$3*H9)+$O$5
L12: (F0) ($O$3*H10)+$O$5
L13: (F0) ($O$3*H11)+$O$5
L14: (F0) ($O$3*H12)+$O$5
L15: (F0) ($O$3*H13)+$O$5
L16: (F0) ($O$3*H14)+$O$5
L17: (F0) ($O$3*H15)+$O$5
L18: (F0) ($O$3*H16)+$O$5
L19: (F0) ($O$3*H17)+$O$5
L20: (F0) ($O$3*H18)+$O$5
L21: (F0) ($O$3*H19)+$O$5

N7: "Slope =
N9: 'Intercept =
N13: 'Sum of X =
N15: 'Sum of Y =
N17: 'N        =

O7: (F2) ((O17*K19)-(O15*O13))/((O17*I19)-(O13*O13))
O9: (F2) (O15/O17)-(O7*O13)/O17
O13: @SUM(H4..H17)
O15: @SUM(B10..B21)
O17: @COUNT(H4..H17)

P4: @IF(B10>0,B10,0)
P5: @IF(B11>0,B11,0)
P6: @IF(B12>0,B12,0)
P7: @IF(B13>0,B13,0)
P8: @IF(B14>0,B14,0)
P9: @IF(B15>0,B15,0)
P10: @IF(B16>0,B16,0)
P11: @IF(B17>0,B17,0)
P12: @IF(B18>0,B18,0)
P13: @IF(B19>0,B19,0)
P14: @IF(B20>0,B20,0)
P15: @IF(B21>0,B21,0)
```

```
P16: (F0) @IF(E10<>0,E10,0)
P17: (F0) @IF(E11<>0,E11,0)
P18: (F0) @IF(E12<>0,E12,0)
P19: (F0) @IF(E13<>0,E13,0)

Q2: 'GRAPH STUFF
Q4: 'F
Q5: 'S
Q6: 'F
Q7: 'S
Q8: 'F
Q9: 'S
Q10: 'F
Q11: 'S
Q12: 'F
Q13: 'S
Q14: 'F
Q15: 'S
Q16: 'F
Q17: 'S
Q18: 'F
Q19: 'S

R4: "   80-1
R6: "   81-2
R8: "   82-3
R10: "   83-4
R12: "   84-5
R14: "   85-6
R16: "   86-7
R18: "   87-8

T2: 'Graph Macro = [Shift][Ctrl] G
T4: '/GRGTBXR4..R19"AP4..P19"
T5: 'OLASemester Enrollment"TF®B1"
T6: 'TSEnrollment History and Projections"
T7: 'TX80-86 = History; 86-88 = Projections"
T8: 'TYEnrollments"DAQ4..Q19"AQQV

T11: 'Print Macro = [Shift][Ctrl] = P
T13: '/PPRA1..G25"GPQ
```

NOTE: To invoke the macros in column T, you must first "name" them. Place the cursor on cell T4 and press the following keys in sequence: "/RNC®G<Return><Return>". Then place the cursor on cell T13 and press these keys in sequence: "/RNC®P<Return><Return>".

Appendix B: Instructions for Using the Enrollment Projection Template

What follows presumes a minimum ability to use Lotus' 1-2-3.

Using the Template As-Is

1. Retrieve the template.
2. Go to cell B1. Type in the program title in caps as a left-aligned label. (Doing so will replace "[PROGRAM TITLE (Campus)]."
3. Go to cell A2; edit the line to delete each "[term year]" and replace them with the semester and year that your enrollment history begins and ends.
4. Go to cell A3; edit the line to delete each "term year" and replace them with the semester and year that the projection begins and ends. (Retain the parentheses.)
5. Go to cell A10; edit the line to complete the date. Edit the remaining thirteen lines in column A in the same way. (If you do not have enrollment data as far back as Fall 1978, Range-Erase A10..A13 and Move A14..A23 up to A10..A19. See "Changing the Template for More/Fewer Semesters" for other changes.)
6. Go to cell D10; edit the line to complete the date. Edit remaining three lines in the column in the same way.
7. If you do not have data going back to the Fall 1978 semester, go to cell R4; edit the line to make it correspond to cells A10 and A11. That is, if cells A10 and A11 are Fall 1978 and Spring 1979 respectively, then cell R4 should be 78-9. Edit all the remaining lines in the column in the same way. Each cell in column R identifies an academic year listed in column A.

8. If your enrollment history data does not begin with the Fall 1987 term, go to cell T7 and edit the line to make it reflect the years you actually use.

8. Go to cell B10; enter the enrollment for that term. Complete the column. Note that projections in column E will automatically change with each new entry in column B. (The same is true for columns J, K, L, M, O, and P.)

9. When finished data entry for column B, [Ctrl][Shift] P will print the first screen with the data (range A1 through G20), and [Ctrl][Shift] G will produce a bar graph. (See ranges T2..T8 and T12..T14.) (NOTA: the macro keys may be different on other keyboards; I am using a DEC. If the macro keys are different on your PC, edit cell T2 accordingly.) Save the graph and print it using Lotus' Printgraph. You may also wish to print cells A1..F23 in order to have a hard copy of the first screen.

Changing the Template for More/Fewer Semesters

1. Add more semesters by lengthening column A or columns D and E; delete semesters by shortening column A or columns D and E. (I recommend against using fewer than ten semesters of enrollment history: the resulting projections may not be reliable with fewer.)

2. Change the semester number on each line of column E's formulae. (The semester number follows the asterisk. See the text at cell A4.) The semester number in cell E10 must always be one more than the number of semesters of data in column A; the semester number in cell E11 must always be one more than that, and so forth.

3. Add or subtract lines from columns H, I, J, K, L, P, and R. To add lines, first use the Move command to drop the dotted and SUM lines (H19..L19) down, then use the Copy command to copy the formulae from the last line to the new ones for H, I, J, K, and L. You will have to add to columns P and R row by row. To delete lines, first use the Range Erase command to delete the lines you do not want (starting at H17..L17 and going upward), then use the Move command to relocate the dotted and SUM lines. Correct the SUM line to reflect the new number of lines in the column.
4. Change some of the column O formulae. Change nothing in the Slope and Intercept formulae: they change automatically when you move the sum formulae at the bottom of columns H through K. For the Sum of X, Sum of Y, and N formulae, change only the second row number in each.
5. Change the range addresses and years in the macro in column T to correspond with changes in your data columns.
6. Good luck!

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